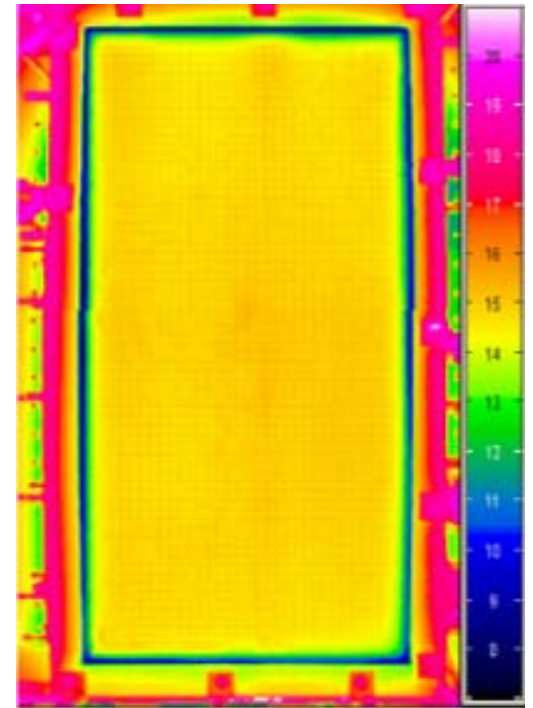


# VIG TG Update Fall 2019

- Jean Michel Dussault - Veridis
- Mahabir Bhandari - ORNL
- Dave Cooper, Chair - Guardian
- D. Charlie Curcija - LBNL



# Contents

- Testing and Modeling Update
  - Jean Michel Dussault - Veridis
- GHP Testing Update
  - Mahabir Bhandari - ORNL
- Industry Association Update / Field Installations
  - Dave Cooper - Guardian



# Project updates - Physical Testing - Veridis

- COG measurements (20" x 20" samples)  
As per ASTM C518 following ASTM C1045 practice and ISO19916 standard, Annex A
  - Samples (6) from VIG manufacturer #1 (Guardian)
    - Tests initiated at ORNL (July 2019) and currently undergoing
  - Samples (6) from VIG manufacturer #2 (ICESUN)
    - Tests pending reception of samples from Milgard
- Window measurements (fixed windows)  
As per NFRC 102 standard
  - Windows (2) from Milgard, glazed with Guardian VIG
    - Windows received at UL, tests to be performed
  - Windows (2) from Milgard, glazed with ICESUN VIG
    - Tests pending reception of samples



# Project updates – Numerical modeling

- COG and Window numerical models

As per ANSI/NFRC 100 standard

- Models with Guardian VIG

- COG modeled in W7

- Pending the complete set of ASTM C518/ISO19916 tests data to move forward with data analysis and model verifications (pressure levels and effective thermal conductivity)

- Windows modeled in T7 and W7

- Additional technical information to be provided by Milgard, T7 sections to be updated based on updated information
- Pending the complete set of NFRC 102 tests data to move forward with data analysis and model verifications

- Models with ICESUN VIG

- Modeling work pending reception of technical information from ICESUN



# VIG measurements at ORNL

- Measurements per ISO 19916
- Temperature setpoints: 2.5C and 17.5C
- Mean temperature: 10C
- Additional temp setpoints explored: -5C and 10C (mean temperature 2.5C)
- Buffer plates thermal resistance: 0.03 and 0.1 m<sup>2</sup>K/W
  - Measured : 0.094 m<sup>2</sup>K/W

**ISO 19916-1:2018**

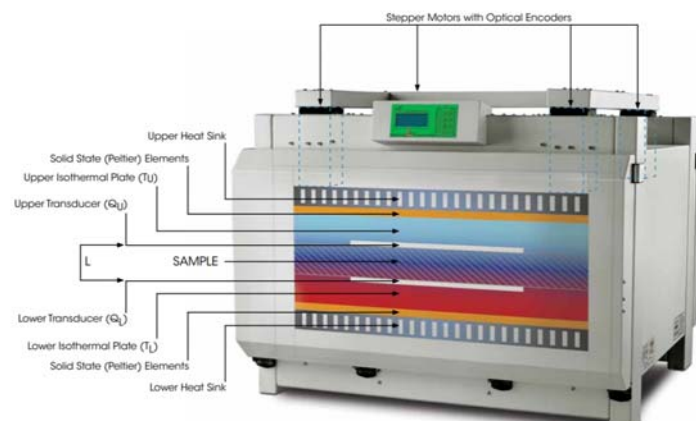
GLASS IN BUILDING -- VACUUM INSULATING GLASS --  
PART 1: BASIC SPECIFICATION OF PRODUCTS AND  
EVALUATION METHODS FOR THERMAL AND SOUND  
INSULATING PERFORMANCE



# VIG measured : instruments used

- Fox 605 and 670
- Heat flow meter method (ASTM C 518)
  - Specifications

	<b>FOX 600</b>
Maximum Sample Thickness	200 mm (8 inch)
Square Sample Width <sup>[1]</sup>	610 mm (24 inch)
Temperature Range	-15 °C to 65 °C
Temperature Resolution	±0.01 °C
Accuracy	±1%
Reproducibility	±0.5%
Thermal Conductivity Range <sup>[2]</sup>	0.001 to 0.35 W/m·K (0.007 to 2.4 BTU in/hr ft <sup>2</sup> °F)
Available Configurations	Automatic Sample Feeder External Thermocouple Kit Rotational System
Proprietary Thin Film Heat Flux Transducer	254 mm × 254 mm (10 in) (ASTM) 300 mm × 300 mm (12 in) (ISO) Top and bottom

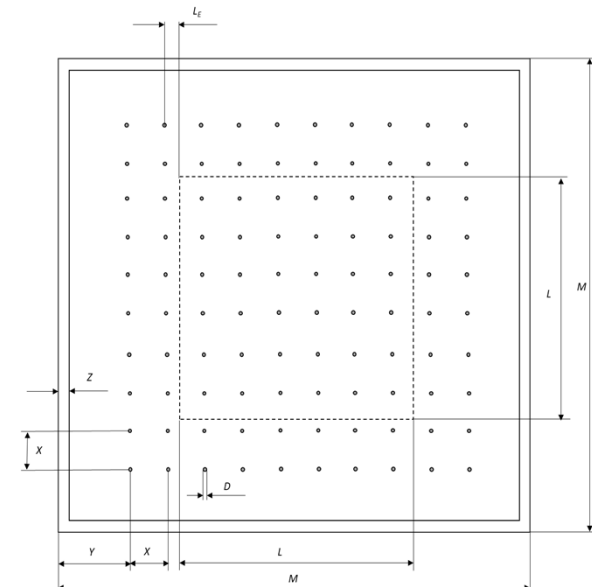
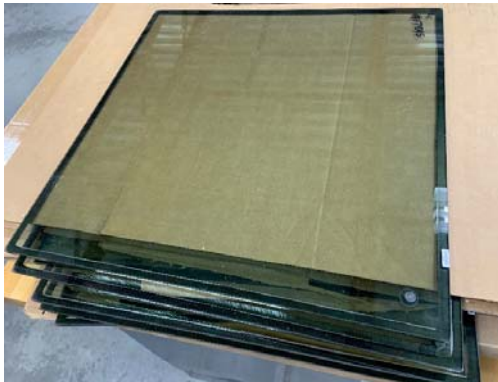


Photo/text credit: LaserComp/TA Instrument brochure



# VIG measurement : Set up

- First set: Guardian Glass (20" x 20')
- Charlie and Howdy Goudey (LBNL)
- Measure buffer plates
- 3 different pillar positions



# Preliminary Results

Test Num	Description
1	VIG 1 - with VIG placed in the center
2	VIG 1 - with VIG moved 0.5" down from the center
3	VIG 1 - with VIG moved 1" down from the center
4	VIG 2 - with VIG placed in the center
5	VIG 3 - with VIG placed in the center
6	VIG 4 - with VIG placed in the center
7	VIG 1 - with VIG placed in the center-Fox 670

Shifting pillar positions in metering area did not make any significant difference : Tests 1, 2 and 3

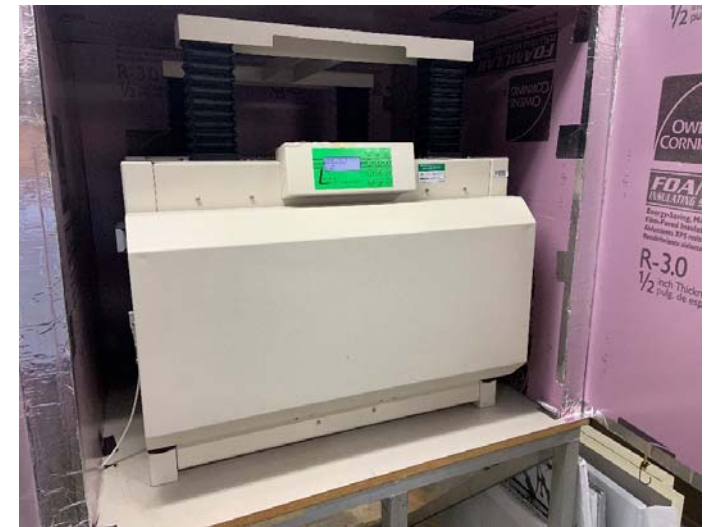
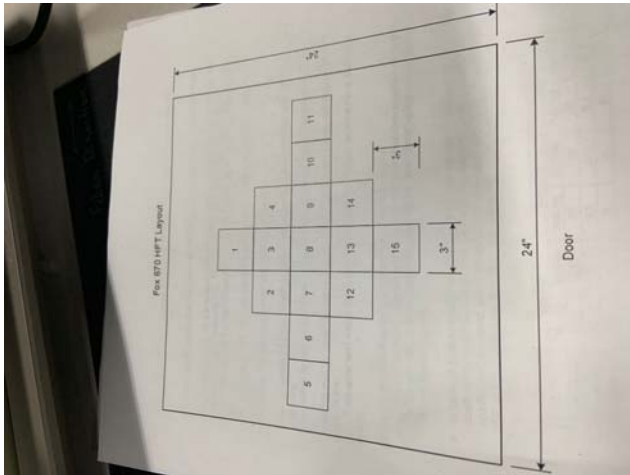
Measurement Name	Measurements				Calculations		
	Delta T	Mean T	Thickness	Overall k	Overall R	Sample R	Sample k
	F	F	in.	Btu-in/(hr-ft <sup>2</sup> ·F)	hr-ft <sup>2</sup> ·F/Btu	hr-ft <sup>2</sup> ·F/Btu	Btu-in/(hr-ft <sup>2</sup> ·F)
Buffer Plates	59.02	50.03	0.7551	0.727	1.038	1.038	0.727
VIG Test 1	59.02	50.03	1.0642	0.094	11.310	10.272	0.030
VIG Test 2	59.02	50.03	1.0657	0.094	11.327	10.289	0.030
VIG Test 3	59.02	50.03	1.0642	0.094	11.336	10.297	0.030
VIG Test 4	59.02	50.03	1.0697	0.090	11.923	10.884	0.029
VIG Test 5	58.98	49.99	1.0677	0.096	11.079	10.041	0.031
VIG Test 6	58.96	50.00	1.0677	0.103	10.363	9.325	0.034
VIG Test 7	58.95	50.01	1.0657	0.102	10.460	9.422	0.033





# Next steps

- Additional measurements in Fox 670
  - 15 heat flux sensors (Fox 605 has two sensors)
- Measure 6 samples – ICESUN VIG



# VIG Association Activities

1. NFRC – TG; incorporate VIG into NFRC documents for modeling for rating
2. ISO – TC-160 / SC-1 / WG-10; VIG Test Standards
3. IGMA – TG; add VIG to Glazing Guidelines
4. DIN – Create new European standard for certification
5. NGA (aka GANA) VIG Task Group



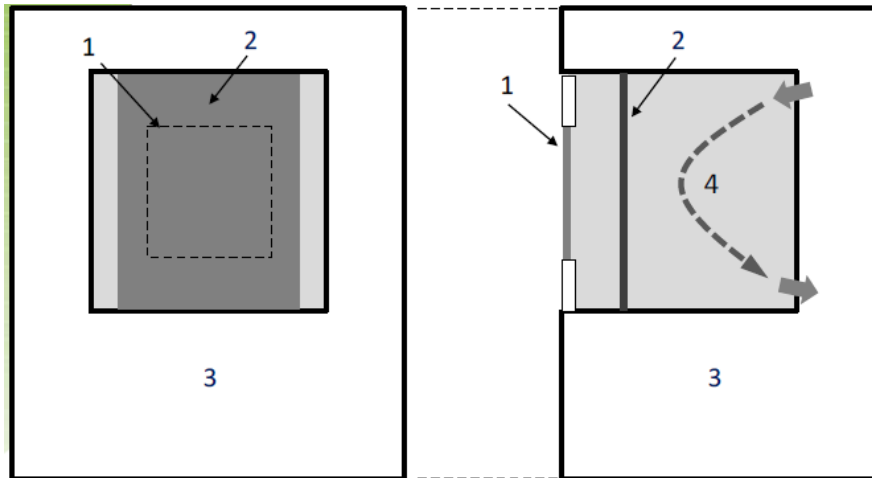
## 2. NFRC - Objectives

1. Add VIG content to NFRC documents  
**DOCUMENTATION CHANGES MADE – BALLOTS ON HOLD PENDING TESTING AND SIMULATION COMPLETION**
2. Test validation of Window simulation  
**RFQ AWARDED TO VERIDIS SOLUTIONS.**
3. Test VIG thermal performance (Hot Box and GHP tests)
  - A. Send VIG units to Milgard for glazing – **1 done, 1 to go**
  - B. Run LBNL Window/Therm VIG simulations on as built samples. **1 done, 1 to go**
  - C. Compare test results to simulations. Adjust LBNL software as required.
4. Ballot and publish NFRC documents.



# 1. ISO Working Group

- Working group has met 13 times
- ISO 19916 part 1 is published: Standard for specification, acoustic and durability performance.
- Part 3 now being worked on (part 2 stricken); Evaluation of Performance Under Temperature Difference.



## Key

- 1 Vacuum insulating glass specimen
- 2 Board
- 3 Cooling or heating chamber
- 4 Air circulation

# 3. IGMA TG

- 1. Gather Literature (done)
- 2. Create VIG TB (definition and use - done)
- 3. Glazing Guideline update with VIG (Next)



IGMA  
Published



## 4. DIN/EN

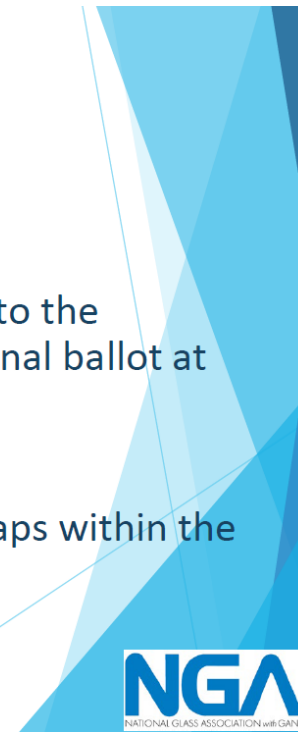
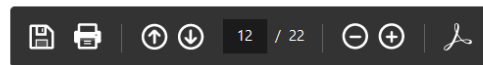
- Group of European interested parties designing a test standard in order to mark VIG with CE label to enable use in buildings.
- There is a work around – but not convenient.
- The ISO VIG standard “cannot be used” for this purpose.



# 5. NGA (aka GANA) Task Group

## Technical activities - NEW, in PROGRESS

- ▶ Compression of Interlayers
- ▶ Laminated Glass Deflection Table
- ▶ Decorative Glazing “Reference” Manual
- ▶ Compatibility Testing of Glazing Materials Related to the Performance of PIB in IGUs (jointly with IGMA) – final ballot at both NGA and IGMA
- ▶ **VIG task group – New from Annual Conference**
- ▶ ~~Frame and Perimeter Insulation Issues - thermal gaps within the framing~~



“**Vacuum Insulating Glazing** is another new task group using Fabricating Committee member feedback to shape the development of an introductory educational document on the capabilities of VIG products.”

